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## Microcardia in the African

BY

TREVOR PARKER

AND

MICHAEL GELFAND

*Department of Medicine, University of Rhodesia.*

We have been aware for some considerable time of the existence of what has been called "the small or tiny" heart in our Rhodesian African adult patients admitted to Harare Hospital. It is our purpose merely to draw attention to its existence and so perhaps encourage those in other parts of Africa or other parts of the world to describe their experiences. We usually found the condition in those who appeared to be underweight rather than suffering from a specific nutritional disorder like scurvy or pellagra. Indeed in these disorders of malnutrition, the heart is either normal in size or may be enlarged. However, it was found in a large series of children in South Africa with Kwashiorkor, that the cardiothoracic diameter was significantly decreased, (Smythe, Swanepoel, Campbell 1962) to increase again on recovery.

### ANATOMICAL CONSIDERATIONS

There are several methods of determining heart size all of which have their critics. Amongst these is the cardiothoracic ratio which is the transverse diameter of the heart over the widest internal diameter of the thorax and which should not exceed 0.5. In normal adults the transverse diameter of the heart averages 12.2 cm. in the male and 11 cm. in the female, the range being 8 to 14.5 cm. (Roesler 1937).

As we used the transverse diameter of the heart to decide on what would be a "small heart", and also as it has been the subject of much discussion, it would be in order to discuss it briefly.

Jacobs (1949) found that the use of the transverse heart diameter is justified by the fact that no better correlation is obtained while complexities are introduced when area (or other measures) are used. Comeau and White (1942) found that

the transverse diameter of the heart compares favourably with the other actual measurements and is the most satisfactory from the clinical standpoint. Indeed, by using this diameter along with other parameters Gustafson and Friedenberg (1965) were able to differentiate qualitatively occlusive coronary artery disease, aortic valve stenosis or insufficiency and coarctation of the aorta.

In a recent study on variations in transverse cardiac diameter during diastole and systole, Gamiil (1970) showed that in 324 patients, 52 per cent. of patients showed changes of 0.3 cm. or less, 41 per cent. showed alterations of 0.4 to 0.9 cm. and 7½ per cent. a variation of 1.0 to 1.7 cm. It was concluded that the set of films (i.e. one exposed during diastole and one exposed during systole) was more useful in evaluating heart size than one film exposed at a random point along the cardiac cycle.

Both the size and shape of the heart vary greatly in normal individuals. For instance in lean asthenic subjects the heart may be elongated and central in position, whereas in short stocky individuals it tends to lie transversely. Rotation of the spine may cause displacement or rotation of the heart. In emphysema the heart tends to be small and vertical because the diaphragm is low.

As yet there is no established range or normal heart weights in the Rhodesian African. It was found that the heart of the Ugandan African was smaller than those reported from Europe and America because the Ugandan African was a small person (Coles and Davies 1959).

Concurrently the authors could not support the view that heart weight rises with age irrespective of body weight.

In an autopsy study on Jamaicans of mainly African origin, Hayes and Levill (1966) reported similar findings to those found in Uganda i.e. lower heart weights than those from Britain and North America. Similarly, they stated that the differences in heart weight are probably correlated with differences in body size. It is likely therefore that a study here in Rhodesia would reveal similar results, although this is conjecture.

## PATHOPHYSIOLOGICAL CONSIDERATIONS

Keyes *et al.* (1947) drew attention to the reduced heart size in semi-starvation. As total blood volume remained in the normal range, the reduced cardiac size was attributed to myocardial wasting, and the degree of calculated reduction in volume of the heart (16 per cent.) approximated to the overall loss of weight (25 per cent.) Previously held views that the heart being a vital organ enjoyed preferential nutritive status, appeared to be incorrect.

Swanepoel *et al.* (1964) state that little attention has been directed towards the heart in starvation, and the probability that it may waste in common with muscle elsewhere has been largely overlooked. Possibly this is because the heart being a robust organ, has a large structural and functional reserve, so that the substantial loss of muscle bulk fails to exert clinical effects.

Bloom (1966) found that heart size decreased in 21 fasting subjects and plasma volume in 7 of these (he measured apparent volume of distribution tagged with  $^{131}$ ), decreased significantly also. No correlation was found between change in heart size or blood volume and amount of weight loss or duration of fasting. These findings were related to the saluresis of fasting.

Simonson (1948) states that there are profound changes in the size and function of the heart in semi-starvation and subsequent rehabilitation. Further, except for the beriberi heart, the condition of the heart in states of malnutrition has found little attention in clinical medicine. Authors as a rule rather tend to believe that nutritional effects on the myocardium were insignificant. In observations on the ECG in semi-starvation, Simonson found highly significant changes occurred in most electrocardiographic items and the ECG's became clinically abnormal in the majority of subjects. These included pronounced slowing of the heart rate (mostly sinus bradycardia), QT interval increase, considerably decreased amplitudes of all deflections (P wave, QRS complex and T wave) and marked right axis shift of the QRS axis and even more of the T axis.

Kjelberg (1949) found a very high correlation between heart volume and total haemoglobin or blood volume.

Experimental hypophysectomy in rats was shown to cause a rapid and progressive diminution in the size of the heart proportionately greater than the concomitant loss of body weight. This was attributed to lower demands on the heart

(lowered venous return, decreased cardiac output and hypotension) resulting from a reduced metabolism. (Beznak, 1960).

Haggveit (1966) reports three cases of small hearts in women who had undergone hypophysectomy for mammary cancer. These patients were not emaciated. Kerley (Textbook of X-ray Diagnosis) mentions the small heart and is worth quoting in full; "Wenkebach postulated the theory that the small heart was due to insufficient venous return because of a low weak diaphragm and a diminished respiratory reserve. Other authors have stated that the small heart may be due to diminished tone in the splanchnic vessels or in the skeletal muscles so that the heart is never adequately filled, and on the Continent the small heart shadow has been associated with such symptoms as fatigue, weakness, headache, fainting etc. There is no proof of such an association. It is true that in many chronic wasting diseases, atrophy of the heart muscle and a weak peripheral circulation produce a small heart shadow and with great loss of body fluid such as occurs in severe dysentery, haemorrhage and starvation, there may be significant decrease in the transverse diameter of the heart. Apart from such exceptional circumstances, a small heart shadow should never be considered in terms of pathology."

Certain drugs are known to produce a reduction in heart size:— Digitalis produces a significant decrease in the size of the *normal* heart. Amyl nitrate causes a slight decrease in size by decreasing vagal tone. Atropine causes a dramatic decrease in heart size in sinus bradycardia.

## DEFINITION OF SMALL HEART

For the purpose of deciding which of our African hospital patients had a significantly small heart, the following method was adopted. 100 male and 100 female chest X-rays which were free from gross pathology were taken from the files.

The distance ( $x + y$ ) was measured on all. This is the transverse cardiac diameter. The mean for the males was 12.6 cms. Statistically it would be anticipated that about  $2\frac{1}{2}$  per cent. of normal hearts would be smaller than 12.6 cms.—12.68 and we decided that 10 cms. would be our limit so that a "small" male heart would be equal to or smaller than 10 cms. The female's average transverse cardiac diameter was 11.75 cms. with a standard deviation of 1.89 and we selected 8 cms. as the limit. We did not include cases of emphysema in this study, as mentioned previously; an artificially small heart is produced.

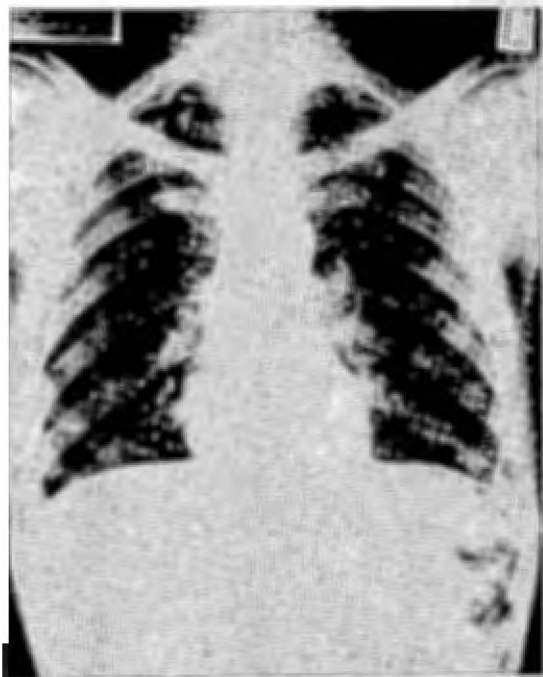


Fig. 1.—Transverse diameter of heart is 9,5 cm.

#### CASE ILLUSTRATIONS

(1) W.M. — A male aged 52 years was admitted to hospital in March 1971 because of severe anaemia (8.O.G.) which proved to be megaloblastic. He was weak and markedly wasted, his weight being 90 lbs. He was troubled with a diarrhoea but the cause of the anaemia could not be put down to a malabsorption syndrome. The transverse diameter of his heart was 9,5 cm. (Fig. 1). He lived in the Eeki Tribal Trust Lands.

(2) J.M. — A male over 20 years was referred from Marandellas Hospital in November 1971 suspected of having pulmonary T.B. He was a little thin but otherwise healthy looking. Little else was found on him except that he had old lesions in the lungs consistent with a diagnosis of tuberculosis.

(3) P.M. — A male aged 50 years (Fig. 2) who worked on a European farm was found to be suffering, in March 1971, with carcinoma of the stomach. He was thin and emaciated. His haemoglobin was 11,49 G%. The heart was small, transverse diameter being 9,8 cm. (Fig. 3).

(4) G.Z. — A male aged 38 years who worked in a Salisbury hotel developed a sudden attack of gastroenteritis. He was slightly dehydrated. He

had a good diet. The transverse diameter of his heart was 9,0 cms. His oxogenic steroids were 10,6 mg. per day and 17 oxosteroids 11,5 mg. per day (both normal figures).

(5) W.J. — A female aged 58 years was admitted in a confused state to Harare Hospital (Fig. 4). She was well until one week before when she refused to eat. There was also a history of vague pains in her chest and a slight cough, according to her husband. In January 1970 she was admitted to the psychiatric ward Harare Hospital for treatment for endogenous depression. Her blood pressure then was 100/80 and her haemoglobin 13,7 G%; sodium 132 m/Eq. Her first attack of depression occurred in 1968 when she was treated by Dr. John Forbes for depression. She recovered from this attack. At this time of her admission in 1971 she was much dehydrated, emaciated, stuporose and shouting at odd times. Her skin showed patches of excess or dark pigmentation and in other areas those of hypopigmentation and her hair was sparse and soft and had largely lost its curl. Her blood pres-



Fig. 2.—The patient.

Table I  
Summary of findings in 5 cases.

Name	Age	Sex	Disease	Trans. Heart Diam.	E.C.G.	Haem. G%	Nutrition	Diet	B.P.	Wght.	Sodium	17- Hydroxy	Oxy- genic Steroids	S. Pro- teins	A. Al- bu- men	S. Glo- bulin
P.M.	50	Male	Ca Stomach	9,9	Absent T waves Low vol- tage R.	11,4	Thin, ema- ciated	—	80/ 60	85	132	—	—	TO- TAL 6,3	2,2	4,1
G.Z.	38	Male	Gastro- Enteritis	9,0	Normal	11,6	Mildly de- hydrated	Good diet	115/ 80	—	136	11,5	10,6	7,2	2,1	5,1
W.M.	52	Male	Megalobla- stic anaem- ia, ? Mal- absorption	9,5	—	8,0	Wasted ++	—	115/ 80	90	133	—	—	6,6	3,0	3,6
J.M.	20	Male	? Pulmon- ary T.B.	9,5	—	11,8	Slightly	—	140/ 90	—	130	—	—	—	—	—
Josph.	55	Female	Endogenous depression	7,5	T <sub>1</sub> Absent TV <sub>5</sub> & <sub>6</sub> Low voltage	9,4	Thin	Wast- ing	90/ 60	68	105	—	—	—	—	—
Kafambi	60	Female	Ca of Cervix	7,0	T <sub>1</sub> Absent Precardial leads Normal	8,8	Emaciated & Dehydrated	No ap- petite	90/ 70	80	130	—	—	4,8	1,7	3,1

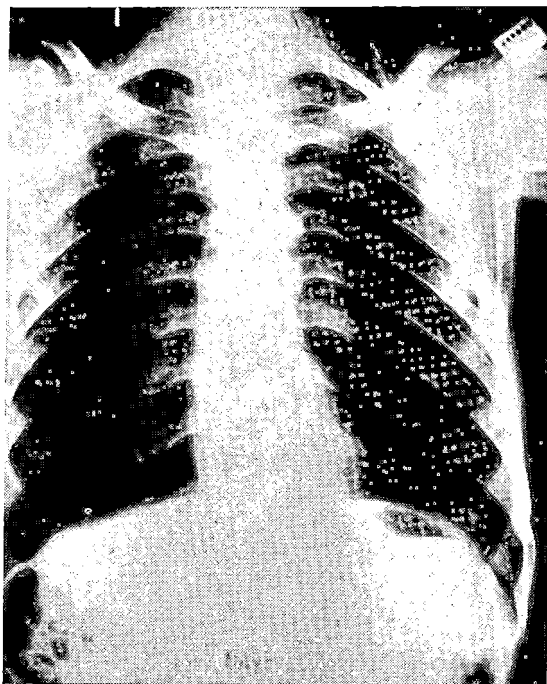


Fig. 3.—The heart of the patient in Fig. 2. The transverse diameter is 9.8 cm.

sure was 90/60. The heart sounds appeared to be normal. No murmurs were audible. Her blood sugar was 76 mg.%, calcium 4.4 m/Eq/l sodium 105 m/Eq/l, blood urea 100 mg.%. Transverse diameter of heart was 7.5 cm. (Fig. 5). With treatment she gradually regained consciousness and began to take an interest in her surroundings.

(6) Kafambi was a very emaciated, dehydrated patient aged about 60 years. (Fig. 6). She complained of lower abdominal pain, accompanied by a severe diarrhoea of eight days duration, but mentioned nothing referable to the heart. Her weight was 80 lbs. and the blood pressure 90/70. No abnormality of the heart was detected on physical examination. The lungs were clear; the liver was not palpable. Both legs were moderately swollen and the neck veins distended.

The results of the six illustrated cases are given in Table I.

#### COMMENT

A small atrophic heart can be expected in gross states of emaciation. Indeed, Wood (1961) would not ascribe any special significance to this. In Addison's disease in which there is characteristically a hypotensive state as well as a hyponatraemia, one may encounter what has come to be known as the vanishing heart syndrome.

One of us has been aware of this state for a long time (Gelfand, 1957) and referred to it in both cases of emaciation and also in patients where there was no sign of malnutrition, i.e. as an isolated finding, without clinical symptoms or signs. This was the case in subject two.

With the prevalence of malnutrition states and kwashiorkor and their rather unknown effects in later life it is tempting to ascribe the small heart to these. However, in a series of South African Bantu cases of malnutrition, the heart was found to be large (Higginson *et al.* 1952). These findings were classified pathologically as a process similar to that of endomyocardial fibrosis but the clinical features were different (Edington, 1963).

The possibility of the small heart perhaps being related to a cardiomyopathy has occurred to the authors. Proof of this is lacking, but Prof. Barclay in a personal communication, states that in cases of cardiomyopathy he has observed, that a large heart is not always the rule and in fact he has found amongst these, anatomically small hearts (by weight only).

Once a normal range of weights for Rhodesian Africans is established it will be possible for histopathological examination to be made of the



Fig. 4.—The female patient, showing the gross wasting.



Fig. 5.—Heart, with a transverse diameter of 7.5 cm.



Fig. 6.—The emaciation of the patient is clearly evident a feature which is often associated with the small heart.

anatomically small heart. Further cases of the small heart will be analysed more closely with special regard to physiological findings such as plasma volume etc., as and when they present.

Whether the small heart has any significance locally or more widely, we cannot at this time say. The literature is excessively scanty on this subject and we feel that having brought it up more thought might be turned in its direction; certainly additional clinical and pathological investigations are needed to confirm this observation.

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#### REFERENCES

- BEZNAK, M. The role of anterior pituitary hormones in controlling size, work and strength of the heart. *J. Physiol.* 150:251. 1960.
- BLOOM, W. L. Changes in heart size and plasma volume during fasting. *Metabolism.* 15:409. 1966.
- COMEAU, W. S. AND WHITE, P. D. A Critical Analysis of Standard Methods of Estimating Heart Size from Roentgen measurements. *Amer. J. Roentgenology.* 66:665. 1942.
- COLES, R. M., AND DAVIES, J. N. P. The normal heart weight of Uganda Africans. *E. Afr. Med. J.* 36:76. 1959.
- EDDINGTON AND JACKSON. *J. Path. Bact.* 86:333. 1963.
- GAMILL, S. L. *Radiology* 94:115. 1970. Cardiac Measurements in Systole and Diastole.
- GELFAND, M. *The Sick African.* Juta. 1957.
- GUSTAFSON, J. E., FRIEDENBERG, J. Evaluation of Left Heart Disease by statistical analysis of aortic parameters diameters. *Amer. Heart. J.* 69:479. 1965.
- HAGGVEIT, H. A. Hypophysectomy and Heart Size. *Amer. Heart. J.* 71:570. 1966.
- HAYES, J. A., AND LOVELL, H. G. Heart weight of Jamaicans. Autopsy study of normal cases and cases of Hypertension and Chronic Lung Disease. *Circulation* 33:450. 1966.
- HIGGINSON, J., GILLANDERS, A. D., AND MURRAY, J. F. The Heart in chronic malnutrition. *Brit. Heart. J.* 14:213. 1952.
- JACOBS, L. G. A New Standard for Heart Size Measurement. *Radiology* 52:103. 1949.
- KERLEY, P. (Editor). A textbook of X-ray Diagnosis. by British Authors. H. K. Lewis. 1962.
- KEYES, A., HENSCHEL, H. AND CAMPBELL, J. A. H. The Heart in Kwashiorkor. *Amer. Heart. J.* 67:1. 1964.
- KJELBERG, S. R., RUDHE, U., AND SJOSTRAND, T. *Acta. Physiol. Scand.* 19:136. 1949. The amount of haemoglobin and the blood volume in relation to the pulse rate and cardiac volume during rest.
- ROESLER, H. Clinical Roentgenology of the Cardiovascular System, London 1937. (Quote from Wood).
- SIMONSON, E., HENSCHEL, A., AND KEYES, A. The electrocardiogram and subsequent rehabilitation. *Amer. Heart. J.* 35:584. 1948.
- SMYTHE, P. M., SWANEPOEL, A. AND CAMPBELL, J. A. H. The Heart in Kwashiorkor. *Brit. Med. J.* 1:67. 1962.
- SWANEPOEL, A., SMYTHE, P. M. AND CAMPBELL, J. A. H. The Heart in Kwashiorkor. *Amer. Heart. J.* 67:1. 1964.
- WOOD, P. Disease of the Heart and Circulation. Eyre and Spottiswoode. London (1961). Second and Revised Edition.



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